Native names: in Yerghum "Chium"; in Hausa, "Rema." —*G. B. Gosling.*

This remarkably coloured dassy is quite unlike any species known to me. Its nearest ally is probably *P. Kerstingi*, Matschie *, from E. Togoland, but that has wholly black backs to its ears, and the hairs of its dorsal spot are dark for their basal halves.

VIII.—*Eocene Shells from Nigeria.*

By R. Bullen Newton, F.G.S.

[Plate V.]

The names of the shells about to be described in this paper have already been published in list-form by the present writer † in 'The Geographical Journal' for November 1904, accompanied by a digest of the literature bearing upon the palæontology of Nigeria and adjacent territories.

The specimens were collected by Colonel G. S. McD. Elliot, R.E., and Captain Lelean, R.A.M.C., of the Anglo-French Niger–Chad Boundary Commission, at Kalfu-Tamaskie and Garadimi, in Northern Nigeria, and subsequently presented to the Geological Department of the British Museum by those officers.

A few general points of interest connected with these shell-remains are referred to in the following quotation, from the article in 'The Geographical Journal':—

"Some of these specimens are preserved as limestone-casts, among them being several *Lucina*, which I have called *L.* cf. *Menardi* and *L.* cf. *pharaonis*, and which represent most probably the forms referred to in Lapparent's papers as *L.* cf. *gigantea*. All three species, however, are typically Eocene, and have mostly been recorded from Egypt or Southern European countries. The specimens of *Alectryonia* cf. *Martinsi*, originally described from India by J. de C. Sowerby under the name of *Ostrea orbicularis*, help to support the theory that this ancient sea had an extensive eastward direction in Eocene times. The peculiar Ostreiform genus *Vulsella*

* SB. Ges. Nat. Berl. 1899, p. 59.

† R. Bullen Newton, "A Notice of some Marine Tertiary Fossils from Northern Nigeria, collected by Colonel G. S. McD. Elliot, R.E., and Captain Lelean, R.A.M.C., of the Anglo-French Boundary Commission," The Geographical Journal, 1904, vol. xxiv. pp. 522–524.

may also be referred to as characteristically Eocene, whilst among the Gastropods *Volutilithes cithara* is important from the distribution point of view, being known from the Eocene areas of England, Europe, Egypt, and India."

Moreover, everything seems to prove that this fauna is of Middle Eocene or Lutetian age, thus confirming the opinion of Professor A. de Lapparent *, who first made us acquainted with the presence of rocks of that horizon in the Soudan area of Africa, from an examination of fossils obtained by Captain Gaden at the same locality as yielded those collected by the British officers, viz. Tamaskie, which is said to be 400 kilometres west of Zinder. These fossils comprised the following Mollusca and Echinoids, the latter having been determined by M. Victor Gauthier :—

Mollusca.	*Nautilus* cf. *Lamarcki*, Deshayes.
	Nerita (*Velates*) *Schmideliana*, Chemnitz.
	Lucina cf. *gigantea*, Deshayes.
Echinoidea.	*Plesiolampas*, sp. n.
	Linthia cf. *Ducrocqui*, Cotteau.
	Rhabdocidaris (*Leiocidaris*).

The distribution of Eocene rocks in African territory north of the Equator appears to be very considerable, since fossils have been recorded of that age from the Cameroons by Dr. Paul Oppenheim †, which were obtained by Dr. Esch, the same palæontologist having also evidence of the Eocene formation at Dahomey from a shell submitted to him by Dr. Joh. Boehm ; and, again, Prof. G. Vasseur ‡ has reported the occurrence of Eocene Foraminifera found at a depth of 230 metres in the kingdom of Senegal. In the more northern and eastern parts of Africa these rocks are again largely developed (including Morocco, Algeria, Egypt, Somaliland, &c.), so that it is quite certain that the Eocene sea must have covered an extensive area of that continent in ancient Tertiary times.

* A. de Lapparent, "Sur les traces de la Mer Lutétienne au Soudan," and "Sur de nouveaux fossiles du Soudan," Comptes Rendus, 1903, vol. cxxxvi. pp. 1118 & 1297.

† Paul Oppenheim, "Vorläufige Mittheilung über des auftreten von Eocän in Kamerun," Centralblatt Mineralogie, Geol. u. Pal. (Stuttgart) 1903, no. 12, pp. 373, 374; "Ueber Tertiärfossilien wahrscheinlich Eozänen alters, von Kamerun," Beiträge Geologie von Kamerun, by Dr. Ernst Esch, &c., 1904, pp. 243-285, pls. vi.–ix.

‡ S. Vasseur, "Sur la découverte du terrain nummulitique dans un sondage exécuté à Saint-Louis du Sénégal," Comptes Rendus, 1892, vol. cxxxiv. pp. 60-63.

Description of the Specimens.

Lamellibranchia.

Ostrea rarilamella ?, Deshayes.

Ostrea rarilamella, Deshayes, Desc. Anim. sans Vert. 1861, vol. i. pls. lxxxi., lxxxii., & vol. ii. p. 109; Archiac, in Tchihatcheff's 'Asie Mineure,' Paléontologie, 1866–1869, pl. x. & pl. xi. fig. 1, p. 135; Zittel, Palæontographica [Libyschen Wüste], 1883, vol. xxx. p. cxi.

The specimen, referred doubtfully to this species, consists of a fragment of an upper valve without, however, its hinge-area. It shows great thickness of shell-structure (=13 millimetres), somewhat distant lamellæ of growth, and a portion of an extensive scar-impression. Beyond the scar-margin the surface of the valve is rounded, smooth, slightly undulating, and dipping towards the outer edge. In the absence of more perfect material, a closer determination is scarcely possible, although the general facies of the specimen compares favourably with the figures and descriptions of this species.

Loc. Kalfu-Tamaskie.

Collector. Colonel Elliot.

Alectryonia cf. *Martinsi*, Archiac.

Ostria orbicularis, J. de C. Sowerby, Trans. Geol. Soc. London, 1840, ser. 2, vol. v. pt. 2, pl. xxiv. fig. 8, non Linnæus.

Ostrea Martinsi, Archiac, Mém. Soc. Géol. France, 1850, sér. 2, vol. iii. pt. 2, pl. xiii. fig. 25, p. 438.

This form is represented by two fragments of a small, depressed, suborbicular, and ostreiform shell having both its valves plicated, and therefore a true *Alectryonia*. Its shape and the bifurcation of the strong, prominent, and rounded costæ suggest affinities with *A. Martinsi*, from the Eocene beds of Cutch and Biarritz, though probably the valves of that shell are rather more convex.

Loc. Kalfu-Tamaskie.

Collector. Colonel Elliot.

Vulsella nigeriensis, sp. n. (Pl. V. figs. 4, 5.)

The collection contains a small subcircular form of *Vulsella* of greater horizontal than vertical measurement. The umbones are nearly central, divergent, and acute, whereas the sides of the valves are furnished with about nine convex radial costæ separated by shallow grooves, which proceed

from just below the umbonal area. Where the original shell is preserved, it is seen to be ornamented with very fine concentric striations originating from the summits, having the tendency of rendering the radial costæ somewhat indistinct. The specimen likewise possesses a well-sculptured triangular chondrophore (fig. 5), so characteristic of the genus, the outer posterior sides of which form a pseudo-alation extending from the divergent summits.

Both valves of the specimen are in the closed condition.

Vulsella is a characteristic genus of Eocene rocks, the present species mainly differing from other described forms in its rounder and more depressed valves.

Dimensions. Umbono-ventral 27 mm.; antero-posterior 30; diameter 11.

Loc. Kalfu-Tamaskie.

Collector. Colonel Elliot.

Spondylus cf. *subspinosus*, Archiac. (Pl. V. figs. 6, 7.)

Spondylus subspinosus, Archiac, Mém. Soc. Géol. France, 1850, sér. 2, vol. iii. pt. 2, pl. xiii. fig. 1, p. 437 (Biarritz); and in Tchihatcheff's 'Asie Mineure,' 1866–1869, Paléontologie by Archiac, pl. xi. figs. 2, 3, p. 149; R. B. Newton, Quart. Journ. Geol. Soc. 1904, vol. lx. pl. xxiv. figs. 24 & 25, p. 289 (Turkey).

This form of *Spondylus*, although related to *S. subspinosus*, a species found in the Eocene rocks of Biarritz, Turkey, and Asia Minor, is slightly more convex, and has a greater number of costæ, and consequently narrower longitudinal grooves. The sculpture-striations (fig. 7) are, however, very similar, being close together and nearly horizontal. The only example found was the larger or lower valve.

Dimensions. Umbono-ventral 48 mm.; antero-posterior 40; diameter 20.

Loc. Kalfu-Tamaskie.

Collector. Colonel Elliot.

Cardium sp.

This specimen consists of a rough cast showing no sculpture characters, but possessing closed valves with a greater height (= umbono-ventral measurement) than length (= antero-posterior measurement), and showing subcentral and rather convex umbones, the hinge-area being somewhat shortened. It is almost impossible from its condition of preservation to suggest any species with which this specimen might be related, although its oblong and subglobose form resembles *Cardium gratum* of Deshayes, a European Eocene species,

which has recently been recorded by Oppenheim from Egyptian rocks of similar age ('Palæontographica,' 1903, vol. xxx. part 3, p. 153).

Dimensions. Umbono-ventral 40 mm.; antero-posterior (approximate) 37; diameter 24.

Loc. Kalfu-Tamaskie.

Collector. Colonel Elliot.

The following casts of *Lucina* probably comprise what Prof. de Lapparent has referred to under the designation of *Lucina* cf. *gigantea*:—

Lucina cf. *Menardi*, Deshayes. (Pl. V. fig. 8.)

Lucina Menardi, Deshayes, Desc. Coq. Foss. Paris, 1825, vol. i. pl. xvi. figs. 13 & 14, p. 94.

Lucina Menardi?, Bellardi, Mem. R. Accad. Sci. Torino, 1854, ser. 2, vol. xv. p. 188.

This form is represented by three limestone-casts with closed valves in very fair condition of preservation. It is of larger size than *L. pharaonis*, and showing coarser radial striations. It differs also from *L. gigantea* in possessing more ventricose valves.

One of the specimens (fig. 8) from Kalfu-Tamaskie exhibits the long, narrow, anterior adductor scar lying slightly above the pallial line. The size of the same specimen agrees with the published figures of Deshayes, which are said to be of natural size, a statement which, however, does not agree with the text, where greater dimensions are given.

Dimensions (the Garadimi specimen). Umbono-ventral 56 mm.; antero-posterior 58; diameter 26.

It is interesting to note in connexion with this determination that Bellardi doubtfully referred an Egyptian fossil to this species.

Locs. Kalfu-Tamaskie and Garadimi.

Collectors. Colonel Elliot and Captain Lelean.

Lucina cf. *pharaonis*, Bellardi. (Pl. V. fig. 9.)

Lucina pharaonis, Bellardi, Mem. R. Accad. Sci. Torino, 1854, ser. 2, vol. xv. p. 190, pl. ii. fig. 12; Oppenheim, Palæontographica, 1903, vol. xxx. pt. 3, pl. xiii. figs. 1 & 2, and pl. xv. fig. 6, p. 124.

Represented by natural casts with closed valves of various sizes, agreeing in its nearly circular shape and diameter with the same form from Egypt, as figured quite recently by Dr. Oppenheim and previously by Bellardi and others. The Nigerian casts exhibit numerous fine longitudinal striations

radiating from the umbonal area which are so characteristic of the internal surface-structure of Luciniform shells.

Dimensions. Umbono-ventral, largest 52 mm., medium 46; antero-posterior, largest 59, medium 47; diameter, largest 23, medium 20.

Locs. Kalfu-Tamaskie and Garadimi (fig. 9).

Collectors. Colonel Elliot and Captain Lelean.

Lucina sp. indet.

Specimen consisting of a natural cast of a Luciniform shell with closed valves possessing nearly central umbones and exhibiting rather wide concentric sulcations. There are also obscure indications of an angulated posterior area. It is of oval shape, somewhat resembling *Fimbria lamellosa*; but as that species has a more complicated sculpture, and is, moreover, without an angulated area, it need not be confused with the present specimen.

Dimensions. Umbono-ventral 40 mm.; antero-posterior 58; diameter 26.

Loc. Kalfu-Tamaskie.

Collector. Colonel Elliot.

Panopæa sahariensis, sp. n. (Pl. V. fig. 10.)

Shell of transversely oval shape, of greater length than height, with anterior umbones and straight hinge-line. Valves inflated in the umbonal region, depressed posteriorly, and with nearly parallel dorsal and ventral margins. Sculpture consisting of rounded, equidistant costæ, separated by fairly wide and shallow grooves.

Dimensions. Umbono-ventral 26 mm.; antero-posterior (approximate) 50 mm.; diameter 27.

Shell related to *Mya intermedia* of James Sowerby, occurring in the Eocene deposits of Britain and Europe, but appearing to differ chiefly in its lesser umbono-ventral measurement, and the possession of nearly parallel dorsal and ventral margins. The sculpture is very similar, the broad equidistant sulcations being clearly expressed. The dorso-posterior part of the valve shows an oblique depression extending from the umbonal region to the outer margin, whilst a second specimen proves that the anterior region was very short.

Two fragmentary natural casts with closed valves represent this form; that figured and described is imperfect anteriorly.

Loc. Kalfu-Tamaskie.

Collector. Colonel Elliot.

Gastropoda.

Calyptræa nigeriensis, sp. n. (Pl. V. fig. 3.)

This form of *Calyptræa* is represented by a natural limestone-cast exhibiting fairly good external characters. It is a subglobular form, and possesses four slightly rounded, depressed whorls, the penultimate being of considerable depth (17 mm.) in front, whilst the last is fractured and imperfect. The surface of the later whorls is ornamented with numerous straight, longitudinal, radial riblets, which are fine at first, but which afterwards become coarser, being thickest near the slightly impressed suture. These radial lines show certain obscure asperities which indicate the former presence of minute spines. The apical surface is apparently smooth.

Dimensions. Summit to margin of basal fracture 44 mm.; transverse diameter 50 mm.

This species appears to show a relationship to *C. aperta* of Solander, from the European Eocenes. It is, however, of less conical form, more spreading and depressed in its volutions, and with a more regular and generally coarser sculpture; the sculpture of *C. aperta* being of a vermicular character, and considerably more minute in the disposition of its spines. On the matrix of this specimen occurs the remnant of an Echinoid plate, with some prominent tubercles which may represent the genus *Rhabdocidaris* referred to in De Lapparent's account of fossils from this area of Africa.

Loc. Kalfu-Tamaskie.

Collector. Colonel Elliot.

Volutilithes cithara, Lamarck. (Pl. V. fig. 2.)

Voluta cithara, Lamarck, Hist. Nat. Anim. sans Vert. 1822, vol. vii. p. 348; Deshayes, Desc. Coq. Foss. Paris, 1835, vol. ii. pl. xc. figs. 11, 12, p. 681; J. de C. Sowerby, Mineral Conchology, 1843, vol. vii. pl. 625, figs. 1, 2, 3; id. Dixon's 'Sussex,' 1850, pl. v. fig. 17, p. 106; F. E. Edwards, Mon. Pal. Soc. 1854, pl. xxiii. fig. 6, p. 176; Archiac, Desc. Anim. Foss. Nummulitique l'Inde, 1854, pl. xxxii. figs. 4, 5, p. 325; Zittel, "Libyschen Wüste," Palæontographica, 1883, vol. xxx. p. cviii.

Volutilithes cithara, Cossmann, Ann. Soc. R. Mal. Belgique, 1889, vol. xxiv. p. 195.

Consists of a limestone-cast of a small compressed example of a Volutiform shell, resembling in every way the *V. cithara* figured by Archiac from India, especially his figure 4, which is likewise a cast. It exhibits the distant longitudinal costæ with the smooth concave interspaces so characteristic of the species. The specimen is very much worn, so that no oblique spiral lines are observable at the anterior end. This

is a frequently found Eocene shell of England, Europe, Egypt, and India.

Dimensions. Length 35 mm.; max. diameter 19.

Loc. Garadimi.

Collector. Captain Lelean.

Rostellaria cf. *goniophora*, Bellardi. (Pl. V. fig. 1.)

Fusus goniophorus, Bellardi, Mem. R. Accad. Sci. Torino, 1854, ser. 2, vol. xv. pl. i. fig. 8, p. 181.

Rostellaria goniophora, Blanckenhorn, Zeitsch. Deutsch. geol. Ges. 1900, vol. lii. p. 446.

A rather compressed limestone-cast of what appears to be an example of Bellardi's *Fusus goniophorus*, from the Nummulitic rocks of Egypt. It comprises three whorls, the earlier part of the spire being absent, on two at least of which can be traced an obtuse posterior angulation beneath the suture. The front or apertural view exhibits the presence of a sharp carination extending from the posterior corner of the mouth, beneath which on the base of the shell occur rather distant, elevated spiral lines. No anterior canal is preserved, the specimen showing a fractured surface where that would originally have been situated. The dorsal aspect closely resembles Bellardi's figure; and it is interesting, further, to note that Dr. Blanckenhorn records the species from the *Alectryonia Clot-Beyi* beds (= Lutetian) of the Fajum district of Egypt.

Dimensions. Maximum diameter 25 mm.

Loc. Garadimi.

Collector. Captain Lelean.

Turritella cf. *ægyptiaca*, Mayer-Eymar.

Turritella ægyptiaca, Mayer-Eymar, Journ. Conchyl. [Paris] 1895, pl. ii. fig. 2, p. 41.

Two fragmentary specimens most probably related to this species. The best preserved exhibits the basal whorl and part of the penultimate separated by a fairly deep suture. This last whorl bears three equidistant carinations and a more obtuse one on the anterior margin formed of two spiral lines very close to each other. Obscure spiral lines are also present on the areas between the carinæ. According to Mayer-Eymar, *T. ægyptiaca* ranges from Upper Cretaceous rocks (Garumnian) to Lower Tertiary (Londonian).

Dimensions of last whorl. Height 19 mm.; width 13 mm.

Loc. Garadimi.

Collector. Captain Lelean.

Conus sp.

This specimen consists of a very rough natural cast of a *Conus* probably related to *C. deperditus* of Bruguière, which is found in Eocene areas. It is of broadly conical form, exhibiting the last three volutions, and furnished with a suture which, in the cast, is deeply canaliculated or concave. There are no sculpture-markings of any kind preserved, nor is the anterior end complete, although its general contour and facies would suggest its connection with a form like *C. deperditus*.

Dimensions. Maximum diameter 35 mm.

Loc. Garadimi.

Collector. Captain Lelean.

EXPLANATION OF PLATE V.

With the exception of figure 7, all the figures are drawn of the natural size.

Fig. 1. *Rostellaria* cf. *goniophora*, Bellardi, sp.
Fig. 2. *Volutilithes cithara*, Lamarck, sp.
Fig. 3. *Calyptræa nigeriensis*, sp. n.
Figs. 4, 5. *Vulsella nigeriensis*, sp. n. Fig. 5 shows the chondrophore.
Figs. 6, 7. *Spondylus* cf. *subspinosus*, Archiac. Fig. 7 shows the striated sculpture, magnified.
Fig. 8. *Lucina* cf. *Menardi*, Deshayes.
Fig. 9. *Lucina* cf. *pharaonis*, Bellardi.
Fig. 10. *Panopæa sahariensis*, sp. n.

IX.—*On new Species of* Helicarion, Ariophanta, Eulota, Cyclotus (Eucyclotus), Lagochilus, *and* Diplommatina (Gastroptychia). By Hugh Fulton.

Helicarion rugosa, sp. n.

Shell globosely depressed, thin, subtransparent, almost imperforate, light brown or horn-colour; whorls 4, slightly convex, upper whorls smooth, the lower covered with rugose spiral striæ, underside of last whorl getting smoother towards the umbilicus, carinated at the periphery; aperture suboval; peristome simple.

Maj. diam. 40; alt. 23 mm.

Aperture: maj. diam. 23; alt. 20 mm.

Hab. N. Borneo (*Waterstradt*).

This large and striking form is quite distinct from any other species known to me.